

CLAIMS

What is claimed is:

- 1 1. A method comprising:
 - 2 accessing a first multi-dimensional graphical representation that describes the
 - 3 appearance of a plurality of points of an object from a plurality of
 - 4 viewing directions, the appearance varying from point to point and
 - 5 viewing direction to viewing direction;
 - 6 creating a second graphical representation that approximates the first graphical
 - 7 representation and that includes at least one expression having a fewer
 - 8 dimensions than the first multi-dimensional graphical representation by
 - 9 decomposing the first multi-dimensional graphical representation into
 - 10 the second graphical representation, the decomposing including
 - 11 selectively representing information from the first graphical
 - 12 representation.
- 1 2. The method of claim 1, further comprising expressing the first graphical
2 representation as a matrix, and wherein creating the second graphical
3 representation includes using singular value decomposition to decompose the
4 first multi-dimensional graphical representation into a first vector multiplying a
5 second vector.
- 1 3. The method of claim 1, wherein creating by decomposing includes selectively
2 representing information from the first graphical representation that is most
3 important to describe the appearance of the object and neglecting redundant
4 information from the first graphical representation that is less important to
5 describe the appearance of the object.

1 4. The method of claim 1, further comprising:
2 accessing a third multi-dimensional graphical representation that describes the
3 appearance of a second plurality of points of the object from a plurality
4 of viewing directions, the second plurality of points including the first
5 plurality of points, and the appearance varying from point to point and
6 viewing direction to viewing direction; and
7 partitioning the third multi-dimensional graphical representation into a
8 plurality of smaller multi-dimensional graphical representations each
9 associated with a primitive of a polygonal representation of the
10 geometry of the object, the plurality of smaller multi-dimensional
11 graphical representations including the first multi-dimensional
12 graphical representation.

1 5. A method comprising:
2 accessing a first graphical representation that describes the appearance of a
3 plurality of points on an object;
4 creating a second graphical representation based on the first graphical
5 representation, the second graphical representation containing less
6 redundant descriptive information than the first graphical
7 representation, and the second graphical representation containing a
8 plurality of portions that are capable of being concurrently combined to
9 display the plurality of points of the object with an appearance
10 associated with a particular viewing direction.

1 6. The method of claim 5, wherein the first graphical representation describes the
2 appearance of a plurality of points of an object from a plurality of viewing

3 directions, the appearance varying from point to point and viewing direction to
4 viewing direction.

1 7. The method of claim 5, wherein creating includes creating a second graphical
2 representation that includes a plurality of portions capable of being expressed
3 as matrices, the method further comprising expressing the plurality of portions
4 as matrices.

1 8. The method of claim 5, further comprising:
2 storing the second graphical representation;
3 receiving a request on a network for the second graphical representation;
4 transmitting the second graphical representation on the network after receiving
5 the request.

1 9. The method of claim 5, wherein creating includes creating a second graphical
2 representation that includes a plurality of portions that can be combined using
3 multitexturing hardware that allows multiple textures to be concurrently
4 applied to a primitive in a single rendering pass.

1 10. The method of claim 5, wherein creating includes creating a second graphical
2 representation that includes a plurality of portions that are capable of being
3 concurrently combined without decompressing the plurality of portions.

1 11. The method of claim 5, further comprising:
2 accessing a third graphical representation that describes the appearance of a
3 second plurality of points of the object from a plurality of viewing
4 directions, the second plurality of points including the first plurality of

5 points, and the appearance varying from point to point and viewing
6 direction to viewing direction; and
7 partitioning the third graphical representation into a plurality of smaller
8 graphical representations each associated with at least one primitive of
9 a polygonal representation of the geometry of the object, the plurality
10 of smaller multi-dimensional graphical representations including the
11 first multi-dimensional graphical representation.

1 12. A machine-readable medium having stored thereon data representing
2 sequences of instructions that when executed cause a machine to perform
3 operations comprising:
4 accessing a first graphical representation that describes the appearance of a
5 plurality of points on an object;
6 creating a second graphical representation based on the first graphical
7 representation, the second graphical representation containing less
8 redundant descriptive information than the first graphical
9 representation, and the second graphical representation containing a
10 plurality of portions that are capable of being concurrently combined to
11 display the plurality of points of the object with an appearance
12 associated with a particular viewing direction.

1 13. The machine-readable medium of claim 12, wherein the instructions for
2 accessing the first graphical representation further comprise instructions
3 causing the machine to perform operations comprising accessing a first
4 graphical representation that describes the appearance of a plurality of points
5 of an object from a plurality of viewing directions, the appearance varying
6 from point to point and viewing direction to viewing direction.

- 1 14. The machine-readable medium of claim 12, wherein the instructions for
2 creating further comprise instructions causing the machine to perform
3 operations comprising creating a second graphical representation that includes
4 a plurality of portions capable of being expressed as matrices.
- 1 15. The machine-readable medium of claim 12, wherein the instructions for
2 creating further comprise instructions causing the machine to perform
3 operations comprising creating a second graphical representation that includes
4 a plurality of portions that can be combined using multitexturing hardware that
5 allows multiple textures to be concurrently applied to a primitive in a single
6 rendering pass.
- 1 16. The machine-readable medium of claim 12, wherein the instructions for
2 creating further comprise instructions causing the machine to perform
3 operations comprising creating a second graphical representation that includes
4 a plurality of portions that are capable of being concurrently combined without
5 decompressing the plurality of portions.
- 1 17. The machine readable medium of claim 12, wherein the instructions further
2 comprise instructions causing the machine to perform operations comprising:
3 accessing a third graphical representation that describes the appearance of a
4 second plurality of points of the object from a plurality of viewing
5 directions, the second plurality of points including the first plurality of
6 points, and the appearance varying from point to point and viewing
7 direction to viewing direction; and
8 partitioning the third graphical representation into a plurality of smaller
9 graphical representations each associated with at least one primitive of

10 a polygonal representation of the geometry of the object, the plurality
11 of smaller multi-dimensional graphical representations including the
12 first multi-dimensional graphical representation.

1 18. A method comprising:
2 accessing image-based data for an object that describes the appearance of the
3 object from a plurality of viewing directions;
4 dividing the image-based data into a plurality of smaller portions associated
5 with regions on the object;
6 standardizing each of the plurality of smaller portions;
7 creating a plurality of approximate graphical representations that approximate
8 the plurality of standardized portions by selectively representing certain
9 non-redundant information from each of the plurality of standardized
10 portions; and
11 storing each of the plurality of approximate graphical representations.

1 19. The method of claim 18:
2 wherein dividing the image-based data includes partitioning the image-based
3 data into a plurality of subsets of image-based data, each subset of
4 image-based data describing the appearance of a primitive-defined
5 region of the object for a particular viewing direction, each subset
6 having a higher degree of spatial coherency than the set of image-based
7 data;
8 wherein standardizing includes normalizing the size of each of the plurality of
9 subsets of image-based data to a predetermined size, normalizing the
10 shape of each of the plurality of subsets of image-based data to a
11 predetermined shape, and using the plurality of subsets of image-based

12 data to compute a resampled plurality of subsets of image-based data
13 that correspond to predetermined standardized viewing directions; and
14 wherein creating a plurality of approximate graphical representations includes
15 creating for each primitive-defined region a first data structure that is
16 independent of the viewing direction and a second data structure that
17 includes a plurality of portions that each correspond to a different
18 viewing direction.

1 20. The method of claim 18, further comprising:
2 acquiring geometry data for an object that describes the geometric extents of
3 the surface of the object;
4 converting the geometry data into a geometric representation of the geometry
5 of the object; and
6 acquiring image-based data that describes the appearance of the surface of the
7 object from a plurality of viewing directions.

1 21. The method of claim 18, further comprising:
2 receiving a request for graphical content associated with the object from
3 another computer system;
4 transmitting a plurality of approximate graphical representations to the other
5 computer system; and
6 transmitting geometry data for the object to the other computer system.

1 22. A data structure comprising at least a first portion and a second portion, the
2 second portion including a second plurality of view-dependent subportions
3 including a first view-dependent subportion that corresponds to a first viewing
4 direction and a second view-dependent subportion that corresponds to a second

5 viewing direction, wherein the first portion and the first view-dependent
6 subportion are combinable using multitexturing hardware that allows multiple
7 textures to be concurrently applied to a primitive in a single rendering pass to
8 display a plurality of points of an object with a first appearance corresponding
9 to a first viewing direction, and wherein the first portion and the second view-
10 dependent subportion are combinable using the multitexturing hardware to
11 display the plurality of points of the object with a second appearance
12 corresponding to a second viewing direction.

1 23. The data structure of claim 22, wherein the data structure is derived from a
2 plurality of images acquired for the object by selectively representing
3 information from the plurality of images that is important to describe the
4 appearance of the object and selectively removing information from the
5 plurality of images that is redundant.

1 24. The data structure of claim 22, wherein the first portion and the first view-
2 dependent subportion are combinable without decompression using the
3 multitexturing hardware.

1 25. The data structure of claim 22, wherein the first portion and the second portion
2 are created by decompressing a corresponding compressed first portion and a
3 corresponding compressed second portion of another data structure.

1 26. A data structure comprising a plurality of portions that are combinable without
2 interpolation to display a plurality of points of the object with a first
3 appearance for a first viewing direction and display the plurality of points with
4 a second appearance for a second viewing direction.

- 1 27. The data structure of claim 26, the data structure being derived from a plurality
2 of images acquired for an object by representing important information that
3 describes the appearance of the object and removing redundant information
4 associated with the plurality of images.
- 1 28. The data structure of claim 26, wherein the plurality of portions are
2 combinable without decompression.
- 1 29. The data structure of claim 26, wherein the plurality of portions are created by
2 decompressing corresponding compressed portions of another data structure.
- 1 30. The data structure of claim 26, wherein the plurality of portions include a first
2 matrix and a second matrix that are concurrently combinable using
3 multitexturing hardware that allows multiple textures to be concurrently
4 applied to a primitive in a single rendering pass.